

REMARKS

Claims 1-20 are pending in the application. Claims 1, 2, 13, 16 and 19 have been amended. Applicants believe that this response addresses the Examiner's rejection and that any changes do not introduce new matter into the specification, limit the scope of the claims or result in any prosecution history estoppel.

Claim Rejections – 35 U.S.C. §112

The Examiner rejected claims 3-12 under 35 USC S. 112, second paragraph, because the dependencies of these claims are unclear. Applicants respectfully note that claims 3-12 have been amended to no longer depend from previously canceled claim 2. In particular, claim 3 has been amended to depend from claim 2.

Claim Rejections – 35 U.S.C. §102(b)

The Examiner also rejected claims 1, 13, 16 and 19 under 35 U.S.C. 102(b) as being anticipated by Hamilton (U.S. Pat. No. 5,629,734). Applicants respectfully disagree with the Examiner's rejection. In particular, Hamilton fails to teach or suggest "computing a color signal includes relatively weighing the pixel signal values by relatively weighing more heavily the pixel signal values associated with the direction increasing less relatively in pixel signal value level for the particular pixel location and **computing the color signal value based upon contributions from both directions**" as claimed or similarly claimed. As noted in the specification on page 6, first paragraph to page 8:

"As illustrated in Fig. 1, the immediately adjacent pixel locations in the horizontal and vertical directions comprise green pixel signal values. Therefore, these shall be employed to estimate the green pixel signal value for this particular pixel location. First, the relative change in the green pixel signal values for the horizontal direction and the vertical direction across this particular pixel location is computed and compared. This is accomplished using the following equations.

$$\begin{aligned} \text{Chor} &= G_{m,n+1} - G_{m,n-1}; \\ \text{Cver} &= G_{m+1,n} - G_{m-1,n}; \end{aligned}$$

If the relative change in the vertical direction is greater than the relative change in the horizontal direction, the relative change being relative to the magnitude of the values computed above, then the values in the horizontal direction, that is, **in this embodiment, the green pixel signal values that are the immediately adjacent pixel signal values in the horizontal direction, are weighed more heavily.** In this embodiment, the weight assigned to horizontal green pixel values have been chosen, based on experimentation, as 0.5, although the invention is not limited in scope in this respect. It is noted that other weights may be employed and provide satisfactory results. At the same time the weights assigned to vertical neighboring green pixel signal values have been chosen as 0.1, although the invention is not limited in scope in this respect. On the basis of the above discussion the missing green pixel signal values in this particular pixel location is estimated as

$$G_{m,n} = [0.5 * (G_{m,n-1} + G_{m,n+1}) + 0.1 * (G_{m-1,n} + G_{m+1,n})] / (0.5 + 0.5 + 0.1 + 0.1); \text{ or}$$

$$G_{m,n} = 0.41667 * (G_{m,n-1} + G_{m,n+1}) + 0.08333 * (G_{m-1,n} + G_{m+1,n});$$

However, if the relative change in the horizontal direction is greater than the relative change in the vertical direction, in terms of pixel signal level for the green pixel signal values, then a reverse approach is employed. More particularly, the vertical green pixel signal values that are immediately adjacent to the red pixel signal value, in this particular embodiment, are weighed more heavily. In particular, the green pixel signal value in this particular pixel signal location is estimated as follows.

$$G_{m,n} = 0.08333 * (G_{m,n-1} + G_{m,n+1}) + 0.41667 * (G_{m-1,n} + G_{m+1,n});$$

It is noted that the form of this equation is similar to the form above, except that the vertical and horizontal pixel signal values that are immediately adjacent to the red pixel signal value have been interchanged. **Finally, if the two relative changes are equal, or substantially equal, then a simple average of the four green pixel signal values that are immediately adjacent to the red pixel signal value are averaged,** for this embodiment, in accordance with the following equation.

$$G_{m,n} = 0.25 * (G_{m,n-1} + G_{m,n+1} + G_{m-1,n} + G_{m+1,n});$$

Therefore, in order to compute the signal value for the green color plane, where the particular pixel location has a pixel signal value in the red color plane, the pixel signal values immediately adjacent to that pixel location in the green color plane are compared. As shall be described in more detail below, it is not always the case that the color plane being computed corresponds to the particular color of the pixel signal values that are compared, although it is true in this embodiment for the situation just described." (Emphasis added.)

Also, as noted in the present application on page 5, first paragraph:

As previously indicated, unfortunately, many color interpolation techniques typically do not produce high-quality color images because the techniques employed typically do not take into account, or at least reasonably correctly take into account, how the human eye perceives color. ***For example, a typical color interpolation technique may include averaging the pixels adjacent to a particular pixel location in which it was desired to interpolate the color signal value for those colors not included in that pixel location of a subsampled color image.*** (Emphasis added.)

Hamilton fails to teach or suggest “relatively weighing the pixel signal values, the relative weights depending, at least in part, on the relative change of pixel signal value level in a particular direction and **computing the color signal value based upon contributions from both directions.**” Rather, Hamilton teaches away from the present invention by computing the color signal value based upon contributions from one direction only. As noted by the Examiner in the Office Action:

In this view, the missing G5 is computed by relatively weighing more heavily the pixel values associated with the horizontal direction (G4, G6 and A3, A5, A7) with weighing coefficient being $_ = 0.5$, $_ = 0.25$ as shown in col. 4, line 51 **while weighting coefficient in vertical direction is zero.**

Also, as noted in Hamilton at column 5, line 66 to column 6, line 7:

The complete green interpolation process may now be expressed as below.

```
IF DH<DV
    THEN G5=G5H
    ELSE IF DV< DH
        THEN GF=G5V
        ELSE G5=G5A
```

Applicants also point out that the Examiner’s statement above is misleading in the sense that the *same* weighing coefficients (i.e. $_$ and $_$) are applied to both the horizontal and vertical predictors G5H and G5V as well as the predictor G5A when there is no clear preference for orientation for the interpolation. As noted in Hamilton at column 5, lines 50-65:

We then form three predictors.

$$G5H=(G4+G6)/2+(-A3+2A5-A7)/4$$

$$G5V=(G2+G8)/2+(-A1+2A5-A9)/4$$

$$G5A=(G2+G4+G6+G8)/4+(-A1-A3+4A5-A7-A9)/8$$

These predictors are composed of arithmetic averages for the green data and appropriately scaled Laplacian second-order terms for the chroma data. G5H is to be used when the preferred orientation for the interpolation is in the horizontal direction within the pixel neighborhood. Similarly, G5V is to be used when the preferred orientation for the interpolation is the vertical direction. G5A is used when there is no clear preference for orientation for the interpolation.

In embodiments of the present invention, the weighing factors are different for both the horizontal and vertical directions. As noted in the quoted passage from the specification, the final color signal value may be based on weighing coefficients of 0.5 for horizontal and 0.1 for vertical components.

In view of the above, Applicants respectfully request that the claims be allowed to issue.

Claim Rejections – 35 U.S.C. §103

Claims 7-12 are patentable over Hamilton in view of Cok for the same reasons noted above. There is also no suggestion to combine the two references.

CONCLUSION

In view of the foregoing, it is respectfully asserted that all of the claims pending in this patent application are in condition for allowance.

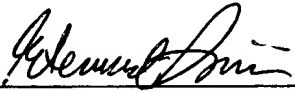
The required fee for a one month extension of time is enclosed. No additional fees are required for additional claims. Should it be determined that an additional fee is due under 37 CFR §§1.16 or 1.17, or any excess fee has been received, please charge that fee or credit the amount of overcharge to deposit account #02-2666.

If the Examiner has any questions, he is invited to contact the undersigned at (323) 654-8218. Reconsideration of this patent application and early allowance of all the claims is respectfully requested.

Respectfully submitted,

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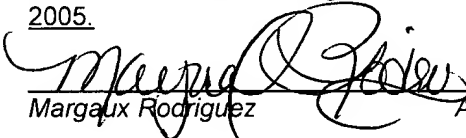
Dated: April 14, 2005

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Margaux Rodriguez April 14, 2005